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MARKETS AND CONSUMERS

APPLICATION OF COMMON KNOWLEDGE AND BELIEF OPERATORS IN CASE OF DISRUPTIVE TECHNOLOGIES

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Key words: Disruptive thinking, disruptive technology, innovations, belief, belief operator, common knowledge, common knowledge operator, consoles, Nintendo, distributed environment.

Abstract: Paper is a case study of console market, where the console makers are identified as group G which shares a distributed knowledge of current consumer expectations. According to the basic logic, it is reasonable to expect that if it is commonly known that a choice A is better than a choice B, any agent i will prefer the choice instead of the inferior one. In case some console makers chose a completely different outcome which is rather based on belief instead of common knowledge.

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Introduction

Common knowledge and belief operators aren't often applied in business papers and even when they are, the sample application doesn't leave the room of a classical example of "muddy children puzzle" or any other variant of the well known "wise men" example. (Barwise, 1981). Despite this fact common knowledge and belief operators can be applied in much more useful and interesting way for current managers and scientists. This paper is an example how useful the tool of operators can be if you try to analyze the current market issues, especially in the field of few players. Why a reasonable player would chose an outcome which would be inferior if the Common knowledge operator was applied and how belief operator could change general reasoning of whole game.

Disruptive technologies and console markets

The term "disruptive technology" usually means that there is a technology which at its starting point is inferior to the competitors, but has something radically new or different - what might attract different customers. Because of this innovation same technology may require a different market from the one that current competitors are targeting. As in many markets technology develops faster than the user needs. It is believed that new disruptive technologies in some time may develop to the stage where they can be good enough for mainstream customers as well. This belief can be expressed as distributed knowledge of group G (G stands for console makers).

$$E_G \Phi \equiv \bigwedge_{i \in G} K_i \Phi$$

In this case we would say that "everyone in G knows Φ " or that group G shares the distributed knowledge of a fact Φ as noted previously by Halpern and Moses (1990). Φ in our problem stands for a product which is good enough for a mainstream customer

Since the very beginning of the console market consoles were developing mainly in the field of game performance. According to that, they are classified to the generations. For example fourth generation consoles (Sega Mega Drive or Nintendo Entertainment System) are also called 16-bit generation. Every next generation improved the game performance dramatically. This was so clear that it has become a common knowledge that if any agent i knew Φ , it was true, or more formally (Halpern and Moses, 1990):

$$K_i \Phi \supset \Phi$$

Fifth generations consoles were the first ones where CDs to record games were used. It is important to mention that on this generation Nintendo chose to follow its prior experience and develop a cartridge based game console Nintendo N64. Nintendo's decision to use a cartridge based system sparked a small scale war amongst gamers as to which was better. Cartridge development was more expensive and generated larger profit margin than the CD-ROM technology. This is believed to be the major reason why Nintendo chose cartridges in that stage. Almost all other systems moved to new CD-ROM technology and many game developers began to embrace new Sony PlayStation because it was cheaper to develop for. In addition, CDs were produced at less expense and they were easier to be managed in production rates according to the demand. Another important thing is that CDs provided more space for game data, what allowed developers use higher quality of texturing - in comparison N64 games, even though they were using 3D engines, the games had no textures at all.

Applying knowledge and believe operators in console market

In November 2005, the seventh generation of game consoles began. This era is also called high definition (HD) era. In this generation there are three major players: Microsoft, Sony and Nintendo. Microsoft has produced Xbox 360, Sony produced PlayStation 3 and Nintendo launched Wii (all these makers belong to console maker group or G). The major difference between Nintendo and the other two consoles is that in high definition game console era Nintendo chose not to invest into development of the HD technology like its competitors did but it focused into integration of controllers with movement sensors instead of joysticks. As an outcome, Wii doesn't support HD technology, its video graphics is inferior to the competitors and it can't be used to play most of the seventh generation games (like Grand Theft Auto IV, Assassin's Creed or some other similar games).

Our former expression that everyone in group G knows Φ basically means the fact that ant agent i knows Φ as well and that this fact is true.

$$E_G \Phi \equiv K_i \Phi \supset \Phi$$

If everyone in G knew that Φ was true, how come Nintendo chose to ignore $E_G \Phi$ and started making a console that was completely different from any other products of other members of group G.

It is clear that Nintendo chose to follow Belief operator instead of Knowledge operator and that in Nintendo's case they presumed that disruptive technology (w) might be more competitive than a mainstream one. In other words:

$$w \gg \Phi$$

Once again, let's define why Wii is disruptive. Basically graphics quality is the traditional factor to evaluate the console performance. Fourth generation consoles had a better graphics quality than third, sixth - better than fifth. Nowadays some people do have TVs that support HD quality, but the majority still doesn't. This is the case where the technology is above the market demand. In order to support HD quality, Microsoft console had to implement dual layer DVDs and PlayStation 3 implemented the Blue-Ray format into its console. Blu-Ray is an optical storage format developed by Sony and Phillips - this is the reason why this format was chosen for example over HD DVD, developed by Toshiba (It is important to mention that high definition optical disc war has ended in February 2008, when Toshiba announced that they closed their HD DVD project - it might be that the reason why Sony chose Blue-Ray is exactly the one that we expect to be after this coincident: to increase the Blue-Ray user numbers and to win the high definition optical disc war against HD DVD, mainly supported by Toshiba). Because of their choice to produce a HD graphic supporting console both Microsoft and Sony had to raise the price of the console. Nintendo on other hand didn't invest into HD technology and their games still run on traditional DVDs. Simple DVD player is cheaper than dual layer or blue-ray supporting player (and it

was much cheaper 2 years ago, when the seventh generation console era was launched). Both Microsoft and Sony consoles are shipped with large hard drives - Wii just doesn't have one at all. To keep information Wii has 512 MB of built in flash memory - which is both cheap and small. As an outcome, price of both Xbox 360 and PlayStation 3 are 400 USD and the price of Wii is 245 USD. Wii is inferior, cheaper and requires a different marketing strategy. As customer won't be able to play traditional seventh generation console games on Wii, mainstream customer won't buy it (at least until it has purchased the Next Generation console). From the very beginning there was a need to find a different customer and it seems that Nintendo was able to find it. Nintendo's belief in its disruptive technology can be very simply expressed in a following formula:

$$B_n w \supset w$$

Traditionally, at least in Europe it is believed that games are usually played by kids or young males. Therefore it is shameful for a grownup to be interested in games. Even though first week sales are usually determined by the adult purchases, during the Christmas sale, majority of the consoles are purchased by parents for their kids. This very key idea probably is the reason why Sony and Microsoft developed consoles that are better than the previous generation consoles. Xbox 360 even supports the old Xbox games allowing the owners of previous generation console safely replace it with new product. Their target is the mainstream customer, who is willing to replace his old rusty PlayStation 2 and is expecting to see a better game graphics once he plugs the console to the TV.

Nintendo with the Wii on other hand challenged the very basic idea that games are for kids. If you watched the Wii games adverts, you would notice that in the advertisements the games are usually played by adults, sometimes even by grandparents. Another interesting thing is that in majority of advertisements where Nintendo tries to present its newly developed controllers with movement sensors, the controller itself is usually held by a female hand (once again - mainstream game player is a male) - male customers might find it attractive, female customers might find this factor encouraging to purchase a console as well.

Very simple fact that Nintendo chose to ignore $E_G \Phi$ and followed belief operator with very simple expression $B_n w$ shows how determined this console maker was. It was all or nothing. If their belief was false then the result was false as well.

$$B_n w \Leftrightarrow w$$

What games does a traditional seventh generation console bring? Traditionally it brings first person shooters, racing games and other games that look beautiful. What games does Wii bring? It is packed with Wii Sports: bowling, tennis, golf and boxing; there are also fishing games, in the shop I've seen a package called Beijing Olympics and Wii Fit - your personal home exercising assistant if you want to practice yoga, want

someone to assist you with push-ups or some other exercises. If PlayStation or Xbox attaches you to the chair, Wii makes you move. This is a totally different gaming experience and marketing strategy as well. You can keep showing on TV happy grandpas playing golf in the room and people will believe that. I really doubt that many people would be affected by similar marketing strategy if it was chosen by Microsoft to advertise its console with leading next generation first person shooters.

Conclusion

An outcome of Nintendo disruptive innovation is that now, when majority of the mainstream console users have purchased their consoles and are bored with playing same or similar games, they want something new or different. As market still can't supply the eighth generation consoles, they may purchase Wii as it provides different gaming experience and is relatively cheap. There is a small chance that the PS3 user will buy Xbox 360 - not because it is expensive, but simply because it offers similar or in many cases even same games to play: there is no need to have two mountain bikes, but you may still want to have a bicycle and roller-skate, even though they both may serve as mean of transportation. Just like Electric vehicle could serve as a second car for mainstream car users in cities, Nintendo may benefit from being purchased by the parents as a new toy for their kids during upcoming Christmas.

Therefore this leads to a very interesting conclusion that

$$B_n w \gg E_G \Phi \text{ and } E_G \Phi \equiv \bigwedge_{i \in G} K_i \Phi \vdash B_n w \gg K_i \Phi$$

or to read it: Nintendo's Belief in disruptive technology (w) was far superior to common knowledge of any agent i in product which is good enough for a mainstream customer.

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